AF/2800

Please type a plus sign (+) inside this box → [+]

PTO/SB/21 (08-00)
Approved for use through 10/31/2002. OMB 0651-0031
U.S. Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE
Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	09/905,398
Filing Date	7/14/2001
First Named Inventor	Nace Layadi
Group Art Unit	2814
Examiner Name	Mai, Anh D.
Total Number of Pages in This Submission	
Attorney Docket Number	Layadi 30-23 (001)

ENCLOSURES *(check all that apply)*

- [✔] Fee Transmittal Form
  - [✔] Fee Attached
- [ ] Amendment / Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [ ] Extension of Time Request
- [ ] Express Abandonment Request
- [ ] Information Disclosure Statement
- [ ] Certified Copy of Priority Document(s)
- [ ] Response to Missing Parts/ Incomplete Application
  - [ ] Response to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Assignment Papers *(for an Application)*
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) _____
- [ ] After Allowance Communication to Group
- [ ] Appeal Communication to Board of Appeals and Interferences
- [✔] Appeal Communication to Group *(Appeal Notice, Brief, Reply Brief)*
- [ ] Proprietary Information
- [ ] Status Letter
- [✔] Other Enclosure(s) *(please identify below)*:

1. Post Card

Remarks

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm or Individual name	**David G. Maire, Esquire Reg. No. 34,865** **Beusse, Brownlee, Bowdoin & Wolter, P. A.**
Signature	David G. Maire
Date	7/10/03

CERTIFICATE OF MAILING

I hereby certify that this correspondence is being deposited with the United States Postal Service with sufficient postage as first class mail in an envelope addressed to: Commissioner for Patents, Washington, DC 20231 on this date: 7/10/03

Typed or printed name	**David G. Maire**		
Signature	David G. Maire	Date	7/10/03

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

PTO/SB/17 (08-00)
Approved for use through 10/31/2002. OMB 0651-0032
U.S. Patent and Trademark Office; U.S. DEPARTMENT OF COMMERCE

FEE TRANSMITTAL for FY 2000

Patent fees are subject to annual revision.

TOTAL AMOUNT OF PAYMENT	($) 320.00

Complete if Known	
Application Number	09/905,398
Filing Date	7/14/2001
First Named Inventor	Nace Layadi
Examiner Name	Mai, Anh D.
Group Art Unit	2814
Attorney Docket No.	Layadi 30-23 (001)

METHOD OF PAYMENT (check one)

1. ☐ The Commissioner is hereby authorized to charge indicated fees and credit any overpayments to:
   - Deposit Account Number
   - Deposit Account Name
   - ☐ Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17
   - ☐ Applicant claims small entity status. See 37 CFR 1.27
2. ☑ **Payment Enclosed:** ☑ Check ☐ Credit card ☐ Money Order ☐ Other

FEE CALCULATION

1. BASIC FILING FEE

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
101	690	201	345	Utility filing fee	
106	310	206	155	Design filing fee	
107	480	207	240	Plant filing fee	
108	690	208	345	Reissue filing fee	
114	150	214	75	Provisional filing fee	

SUBTOTAL (1) ($) 0

2. EXTRA CLAIM FEES

	Extra Claims		Fee from below		Fee Paid
Total Claims		-20** =		X	=
Independent Claims		- 3** =		X	=
Multiple Dependent					=

**or number previously paid, if greater; For Reissues, see below

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description
103	18	203	9	Claims in excess of 20
102	78	202	39	Independent claims in excess of 3
104	260	204	130	Multiple dependent claim, if not paid
109	78	209	39	** Reissue independent claims over original patent
110	18	210	9	** Reissue claims in excess of 20 and over original patent

SUBTOTAL (2) ($) 0

FEE CALCULATION (continued)

3. ADDITIONAL FEES

Large Entity Fee Code	Large Entity Fee ($)	Small Entity Fee Code	Small Entity Fee ($)	Fee Description	Fee Paid
105	130	205	65	Surcharge - late filing fee or oath	
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	
139	130	139	130	Non-English specification	
147	2,520	147	2,520	For filing a request for *ex parte* reexamination	
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	
115	110	215	55	Extension for reply within first month	
116	380	216	190	Extension for reply within second month	
117	870	217	435	Extension for reply within third month	
118	1,360	218	680	Extension for reply within fourth month	
128	1,850	228	925	Extension for reply within fifth month	
119	300	219	150	Notice of Appeal	
120	300	220	150	Filing a brief in support of an appeal	320.00
121	260	221	130	Request for oral hearing	
138	1,510	138	1,510	Petition to institute a public use proceeding	
140	110	240	55	Petition to revive - unavoidable	
141	1,210	241	605	Petition to revive - unintentional	
142	1,210	242	605	Utility issue fee (or reissue)	
143	430	243	215	Design issue fee	
144	580	244	290	Plant issue fee	
122	130	122	130	Petitions to the Commissioner	
123	50	123	50	Petitions related to provisional applications	
126	240	126	240	Submission of Information Disclosure Stmt	
581	40	581	40	Recording each patent assignment per property (times number of properties)	
146	690	246	345	Filing a submission after final rejection (37 CFR § 1.129(a))	
149	690	249	345	For each additional invention to be examined (37 CFR § 1.129(b))	
179	690	279	345	Request for Continued Examination (RCE)	
169	900	169	900	Request for expedited examination of a design application	

Other fee (specify) _____

* Reduced by Basic Filing Fee Paid

SUBTOTAL (3) ($) 320.00

SUBMITTED BY

Name (Print/Type)	David G. Maire, Esquire	Registration No. (Attorney/Agent)	34,865	Telephone	(407) 926-7704
Signature	David G. Maire			Date	7/10/03

WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.

Burden Hour Statement: This form is estimated to take 0.2 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Washington, DC 20231.

#11 Appeal Brief 7.24.03 C. Moore

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

C/M 7.16.03

Re: Application of:

Nace Layadi, et al.

Serial No.: 09/905,398

Filed: 7/14/2001

Title: POLISH OR ETCH STOP LAYER

Group Art Unit: 2814

Examiner: Mai, Amh D.

Attorney Docket: Layadi 30-23

Mail Stop Appeal Briefs - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANT'S BRIEF UNDER 37 CFR 1.192

This brief is in furtherance of the Notice of Appeal filed in this application on May 12, 2003.

The fee required under 37 CFR 1.17(c) is paid concurrently with the filing of this brief in accordance with the accompanying Transmittal of Appeal Brief.

This brief is transmitted in triplicate in accordance with 37 CFR 1.192(a).

1. REAL PARTY IN INTEREST - 37 CFR 1.192(c)(1)

The real party in interest in this appeal is the assignee of the present application, Agere Systems, Inc., a corporation of the State of Delaware.

2. RELATED APPEALS AND INTERFERENCES - 37 CFR 1.192(c)(2)

There is no other appeal or interference that will directly affect, or that will be directly affected by, or that will have a bearing on the Board's decision in this appeal.

3. STATUS OF CLAIMS - 37 CFR 1.192(c)(3)

Claims cancelled: 6, 8-17

(Note: two claims were erroneously numbered 16 in the original application. Because of this mistake, no claim 18 was ever presented in the application).

Claims withdrawn but not cancelled: none.

Claims pending: 1-5, 7, 19-20 and 21.

Claims allowed: none.

Claims rejected: 1-5, 7, 19-20 and 21.

The claims on appeal are 1-5, 7, 19-20 and 21.

4. STATUS OF AMENDMENTS - 37 CFR 1.192(c)(4)

No amendment has been entered after the Final Rejection contained in the Office Communication dated 02/11/2003.

5. SUMMARY OF THE INVENTION - 37 CFR 1.192(c)(5)

The invention is a semiconductor structure including a polish etch stop layer disposed over a layer of a dielectric material in order to protect the dielectric material during the polishing of an overlying layer of metal. The polish etch stop layer may be titanium aluminum nitride (claims 1-5 and 7). Alternatively, the polish etch stop layer may be titanium nitride alloyed with carbon and having a hardness which is 30 to 35 percent greater than a hardness of titanium nitride alone (claims 19-20). These embodiments are illustrated in FIGs. 1 and 2, which show the polish stop layer 18 disposed over a dielectric layer 14 and under a metal layer 20. These embodiments are described in the specification at page 4, line 24 through page 5, line 20.

The invention is further a semiconductor structure including a titanium aluminum nitride etch stop layer disposed over a layer of metal in order to protect the metal during the etching of an overlying layer of dielectric (claim 21). This embodiment is illustrated in FIG. 3, which shows the etch stop layer 34 disposed over a metal layer 28 and under a dielectric layer 26. This embodiment is described in the specification at page 5, line 21 through page 6, line 27.

6. ISSUES - 37 CFR 1.192(c)(6)

(1) Whether claims 19 and 20 are clearly anticipated under 35 USC 102(b) by Konecni (U.S. patent 6,069,072)?

(2) Whether claims 1-5 and 7 are unpatentable under 35 USC 103(a) over Yamashita (JP patent 08-107148) in view of Meikle (U.S. patent 5,231,306)?

(3) Whether claim 21 is unpatentable under 35 USC 103(a) over Yamashita (JP patent 08-107148) in view of Meikle (U.S. patent 5,231,306)?

7. GROUPING OF CLAIMS - 37 CFR 1.192(c)(7)

The appellant agrees that claims 19 and 20 are properly grouped together in the rejection under 35 USC 102(b).

The appellant disagrees that claims 1-5 and 7 should be grouped together with claim 21 in the rejection under 35 USC 103(a). While each of these claims includes the limitation of a titanium aluminum nitride layer, in claims 1-5 and 7 this layer is disposed over a dielectric layer to protect the dielectric layer during the etching of an overlying layer of metal. Conversely, in claim 21 this layer is disposed over a metal layer to protect the metal layer during the polishing of an overlying layer of dielectric. Because the relative positioning of layers of material is technically significant in a semiconductor structure, claims 1-5 and 7 should be grouped separately from claim 21 for purposes of consideration in this appeal.

8. ARGUMENT - 37 CFR 1.192(c)(8)

Issue 1 - Whether claims 19 and 20 are clearly anticipated under 35 USC 102(b) by Konecni (U.S. patent 6,069,072)?

Konecni fails to describe the specific claim limitations of "a polish stop layer comprising titanium nitride alloyed with carbon deposited over the dielectric layer and extending into the via" and "a metal layer deposited over the polish stop layer and filling the via."

The only use of titanium nitride alloyed with carbon that is described in Konecni is with respect to the barrier layer 360 of FIG. 3 and layer 230 of FIG. 2B, which are both

disposed above a respective aluminum (metal) plug 330, 220 and which do not extend into the via. Konecni describes this use of titanium nitride alloyed with carbon in this location above the aluminum plug as being for the purpose of electromigration protection. (see column 4, lines 31-42) The Konecni disclosure fails to describe the claimed combination of titanium nitride alloyed with carbon over a dielectric layer and extending into a via below a metal layer for the purpose of a polish stop layer.

Konecni does describes a barrier layer (liner layer) 205 of FIG. 2A that extends into a via. However, Konecni describes this layer as being titanium nitride (see column 3, line 8) and not as being titanium nitride alloyed with carbon. Konecni fails to describe a layer of titanium nitride alloyed with carbon extending into a via over a dielectric layer. Further, the titanium nitride barrier layer 205 of Konecni is not a polish stop layer. That is, Konecni specifically teaches that a portion of that layer disposed outside the via and designated as 205' will be removed during a subsequent CMP process (see column 3, lines 9-11). Accordingly, Konecni teaches away from the claimed polish stop layer.

Konecni also fails to describe the specific claim limitation of "wherein the polish stop layer has a hardness which is 30 to 35 percent greater than a hardness of titanium nitride alone for protecting the dielectric layer from a chemical mechanical polishing process used to remove a portion of the metal layer deposited outside of the via." This is not an inherent characteristic of the titanium nitride alloyed with carbon that is described in Konecni, since Konecni allows the carbon content to reach 30% (column 4, line 36) for the purpose of electromigration protection, whereas the present specification and dependent claim 20 specifically limit the carbon content to no more than 20% for the purpose of a polish stop function.

Issue 2 - Whether claims 1-5 and 7 are unpatentable under 35 USC 103(a) over Yamashita (JP patent 08-107148) in view of Meikle (U.S. patent 5,231,306)?

The Examiner has failed to satisfy the burden of factually supporting the *prima facie* conclusion of obviousness as required under MPEP 2142. The Examiner admits that Yamashita fails to disclose the claim 1 limitation of "wherein said polish stop layer comprises titanium aluminum nitride." The Examiner states "Meikle teaches that TiAlN are known in the art to be used in place of TiN in semiconductor devices" and that "it would have been obvious to one having ordinary skill in the art at the time of invention

to form the polish stop layer (31) of Yamashita comprises TiAlN as taught by Meikle because TiAlN material is more resistant to diffusion than TiN."

MPEP 2143.01 provides: The mere fact that references can be combined or modified in hindsight does not render that resultant combination obvious. Rather, the prior art must also suggest the desirability of the combination (*In re* Mills, 916 F.2d 680, 16 USPQ2d 1430 (Fed. Cir. 1990)). The fact that titanium aluminum nitride is more resistant to diffusion than titanium nitride is not indicative of the relative performance of these two materials during a polishing process. Diffusion is related to porosity of the material whereas polishing performance is related to chemical reactivity and mechanical strength. The fact that Meikle teaches that TiAlN is more resistant to diffusion than TiN provides no motivation for using titanium nitride alloyed with aluminum in place of titanium nitride as a polish stop layer.

Prima *facie* obviousness also requires a reasonable expectation of success. (*In re Clinton*, 188 USPQ 365) Meikle's teaching regarding the performance of TiAlN for preventing interdiffusion of silicon and aluminum at a silicon/aluminum interface provides no basis for any expectation regarding the performance of that material as a polish stop layer.

Furthermore, Meikle states at column 2, lines 35-36 that "TiAlN etches readily in NH_4OH/H_2O_2 similar to TiN." Thus Meikle provides no motivation for using TiAlN in the device of Yamashita in order to improve its polish stop performance, and thus the Examiner has failed to establish a case for *prima facie* obviousness.

Issue 3 - Whether claim 21 is unpatentable under 35 USC 103(a) over Yamashita (JP patent 08-107148) in view of Meikle (U.S. patent 5,231,306)?

The Examiner has failed to satisfy the burden of factually supporting the *prima facie* conclusion of obviousness as required under MPEP 2142.

First, the Examiner describes the teaching of Yamashita and states "wherein the barrier layer (27) function as an etch stop layer. (See Fig. 6)." This is technically incorrect, since layer 27 of Yamashita has clearly been partially etched away during the dielectric-etching step illustrated in FIG. 5. Thus, Yamashita actually teaches that the material of layer 27, which is titanium nitride, will not function as an etch stop layer.

Meikle states at column 2, lines 35-36 that "TiAlN etches readily in NH_4OH/H_2O_2 similar to TiN." Thus Meikle fails to recognize the significantly different etch properties of these two materials.

Accordingly, it is not proper to combine Yamashita and Meikle since the substitution of titanium nitride alloyed with aluminum from Meikle into the layer 27 of Yamashita would interfere with the etching step of FIG. 5 of Yamashita wherein a portion of that layer is intentionally removed. Thus, the combination of the teaching of Meikle into the device of Yamashita would not result in the intended structure of FIG. 6 of Yamashita, thereby destroying the intent of the Yamashita patent.

Claim 21 includes the limitations of "a layer of titanium aluminum nitride disposed on the metal layer" and "wherein the layer of titanium aluminum nitride functions as an etch stop layer upon removal of the selected portion of the dielectric layer to prevent the etching process from compromising the underlying metal layer." The combination of Yamashita and Meikle fails to establish a *prima facie* case for the obviousness of this claimed combination.

9. APPENDIXOF CLAIMS - 37 CFR 1.192(c)(9)

An appendix containing a copy of the claims involved in this appeal is provided herewith.

Respectfully submitted,

David G. Maire, Reg. No. 34,865
Beusse Brownlee Bowdoin & Wolter, P.A.
390 North Orange Ave., Suite 2500
Orlando, FL 32801
telephone: 407-926-7704

APPENDIX OF CLAIMS

1. (Amended) A semiconductor structure comprising:

a substrate having a device feature formed thereon;

a dielectric layer disposed over said substrate and device feature and having at least one contact hole formed therein;

a polish stop layer disposed over the dielectric layer and extending within the contact hole;

a layer of metal disposed over the polish stop layer within the contact hole and forming a plug; and

wherein said polish stop layer comprises titanium aluminum nitride.

2. (Amended) The semiconductor structure of claim 1 and including a metal coating under said dielectric layer, said metal coating comprising a compound of titanium nitride and aluminum.

3. (Amended) The semiconductor structure of claim 2 wherein the dielectric comprises a silicon oxide.

4. The semiconductor structure of claim 3, wherein the metal coating comprises an anti-reflective coating.

5. (Amended) The semiconductor structure of claim 1, wherein the polish stop layer comprises titanium aluminum nitride with between about 5 and 20 percent by weight of aluminum.

7. The semiconductor structure of claim 2, wherein the metal coating comprises about 5 to 20 percent by weight of aluminum.

19. A semiconductor structure comprising:

a substrate layer;

a dialectic layer disposed over the substrate layer and having a via formed therein;

a polish stop layer comprising titanium nitride alloyed with carbon deposited over the dielectric layer and extending into the via;

a metal layer deposited over the polish stop layer and filling the via; and

wherein the polish stop layer has a hardness which is 30 to 35 percent greater than a hardness of titanium nitride alone for protecting the dielectric layer from a chemical mechanical polishing process used to remove a portion of the metal layer deposited outside of the via.

20. The semiconductor structure of claim 19, wherein the polish stop layer comprises titanium nitride alloyed with between 5 and 20 percent by weight carbon.

21. A semiconductor structure comprising:

a metal layer disposed on a substrate;

a layer of titanium aluminum nitride disposed on the metal layer;

a dielectric layer disposed on the layer of titanium aluminum nitride;

a patterned layer of photoresist disposed on the dielectric layer exposing a selected portion of the dielectric layer to an etching process;

wherein the layer of titanium aluminum nitride functions as an etch stop layer upon removal of the selected portion of the dielectric layer to prevent the etching process from compromising the underlying metal layer.